SOP 2: Counting Adult Monarchs and Documenting Plant Use

Follow these instructions for counting adult monarch butterflies and documenting behaviors, especially their use of nectar plants. You will use a modified Pollard (1977) walk to **survey** adult monarch butterflies. The method entails walking a route (**segment**) and counting all monarch adults observed, along with their activity or behavior, within a set vertical and horizontal distance from the segment line. Counting adult monarchs using this 2 dimensional frame permits a fixed-area count and produces a time-specific index of adult monarch abundance (no/ha). Because monarch abundance varies with time at a given location, it is necessary to perform multiple surveys from spring to fall. During the survey, and when measuring blooming plant frequency (SOP 3), you will also record the species of plant where one or more adults have alighted and appear to be **nectaring**.

Attributes Measured

- Time required to conduct this SOP
- Number of adult monarch butterflies (no./ ha)
- Behavior (category)
- Plant species used by adults for nectaring
- Temperature (ambient C°)
- Sky condition and precipitation category

Equipment and Supplies

- GPS or iPAD with locating functionality
- Data sheets, clipboard, pencil or pen
- 100- meter tape (for checking distances and replacing missing flags)
- Compass
- Cord with key increments marked for quickly measuring short distances
- Pink wire flags and bamboo staffs (replacement materials)
- Black marker
- Plant identification materials (SM 3) and respective field guide
- Hand lens or magnifying glass
- Monarch identification materials (Appendix A) and butterfly field guide
- Camera
- Field thermometer

Data Entry

Record information on (see also SOP 5, SMs 4 and 5):

- Conditions and location of each survey visit using iPad survey form named SOP2_ButterflyWalk or paper form labeled SOP 2 sheet 1;
- Disturbances and survey layout coordinates using iPad survey form named SOP1_SiteDescription or paper data form labeled SOP 1 sheet 1
- Numbers of adult monarch butterflies by distance and behavior (iPad survey form named SOP2_ButterflyWalk or use paper data forms labeled SOP 2 sheet 2.

The Survey Route

Conduct the Pollard walk along a 750-m route at each **plot**. The layout of the segments will differ by **sampling stratum** (habitat and land-use type), as noted in SOP 1: Sampling Site Selection, Description and Assessment. *We have referred to transects that are walked to count butterflies as '**segments**' to distinguish them from transects established to sample plants.*

- In grasslands (unprotected—**UPG**, protected—**PRG**, and agricultural lands enrolled in Conservation Reserve Program—**CRP**) plots, a rectangular loop 300 m long x 75 m wide will be walked (Figure SOP- 2.1).
- At roadside (**RDS**) plots, ten 75-m segments will be walked (Figure SOP-2.2).
- In **AGC** plots that can be entered for intensive sampling, follow the perimeter as in the grassland plots, which will be oriented so that the long side runs within a furrow parallel to planted rows (SOP 1). Transects will start at the farm field edge and proceed towards the field center and then back using a second row separated by about 75 m from the first row, whenever the field width allows. If the rows are long enough two 400 m long distances (5 segments plus 5-m separation intervals) will suffice. For smaller fields, more pairs of transects will be needed to produce 750 m of transect (Fig. SOP 2.3).
- Procedures on how to conduct the walks in urban-suburban area (**USA**) plots will depend on the size of the area being measured. Guidance for these different situations will be forthcoming—check with your survey coordinator for updated information.

Butterfly Survey Layout—Monarch butterfly surveys will be conducted along segments that total 750 m in distance walked. Placement and orientation of those surveys vary by plot type (SOP 1).

1. Conduct the butterfly survey following plot specific routes. Each route will be subdivided into 10 (75-m) segments for recording data. Placement and orientation of the segments will vary by plot type. The ends of each segment should be geospatially referenced (coordinates recorded) or flagged before the day of the survey to avoid disturbing butterflies present at the site.
    a. At grassland plots (PRG, UPG, and CRP), you will walk the perimeter of a 300 m x 75 m rectangular plot, a total distance of 750 m. Segments will be numbered 1–10 and demarcated by pink and orange flags (Figure SOP-2.1). Begin the survey in the north-west corner of the plot and walk clockwise. The first segment that you survey will either be on the short side (75 m) or long side (300 m) of the plot depending on the orientation of long plot axis (east-west or north-south; Figure SOP-2.1a or b).
    b. At a roadside (RDS) plot, you will walk 75-m segments near 10 of 16 plant sampling transects numbered 1, 3, 5, 7, 8, 9, 11, 13, 15 and 16 (Figure SOP-2.2). However, each segment is positioned parallel to the road (not diagonal) 6-m from the road edge. Each of these 10 segments should be marked and numbered 1–10 with orange flags before conducting the first survey (see SOP 1). If flags cannot be left at roadsides, use the GPS locations that were recorded for the start and end of each segment during the first visit (see SOP 1). If a particular segment cannot be done during a visit (e.g., a utility crew is working where a segment would occur) then replace the impacted segment with closest unused (even numbered) RDS transects.

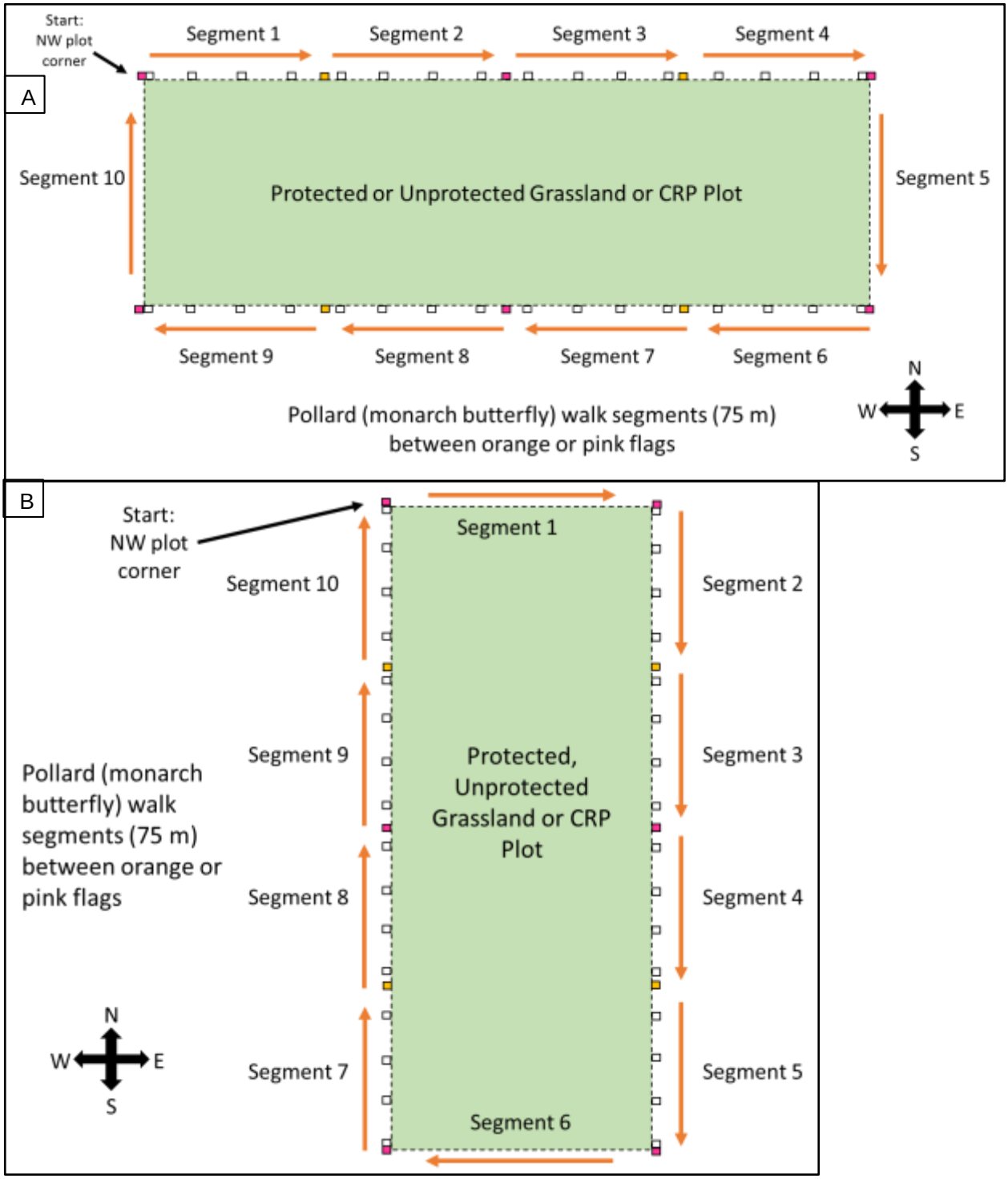

Figure SOP-2.1. Pollard walk segments and direction (orange arrows) for protected and unprotected grassland and Conservation Reserve Land plots with a (A) West-to-East or (B) North-to-South orientation of the long side. Walk the plot clockwise starting from the northwest corner. The survey route is divided into ten 75-m long segments (1–10) marked by pink and orange flags (boxes). White boxes are flags marking ends of plant sampling transects.

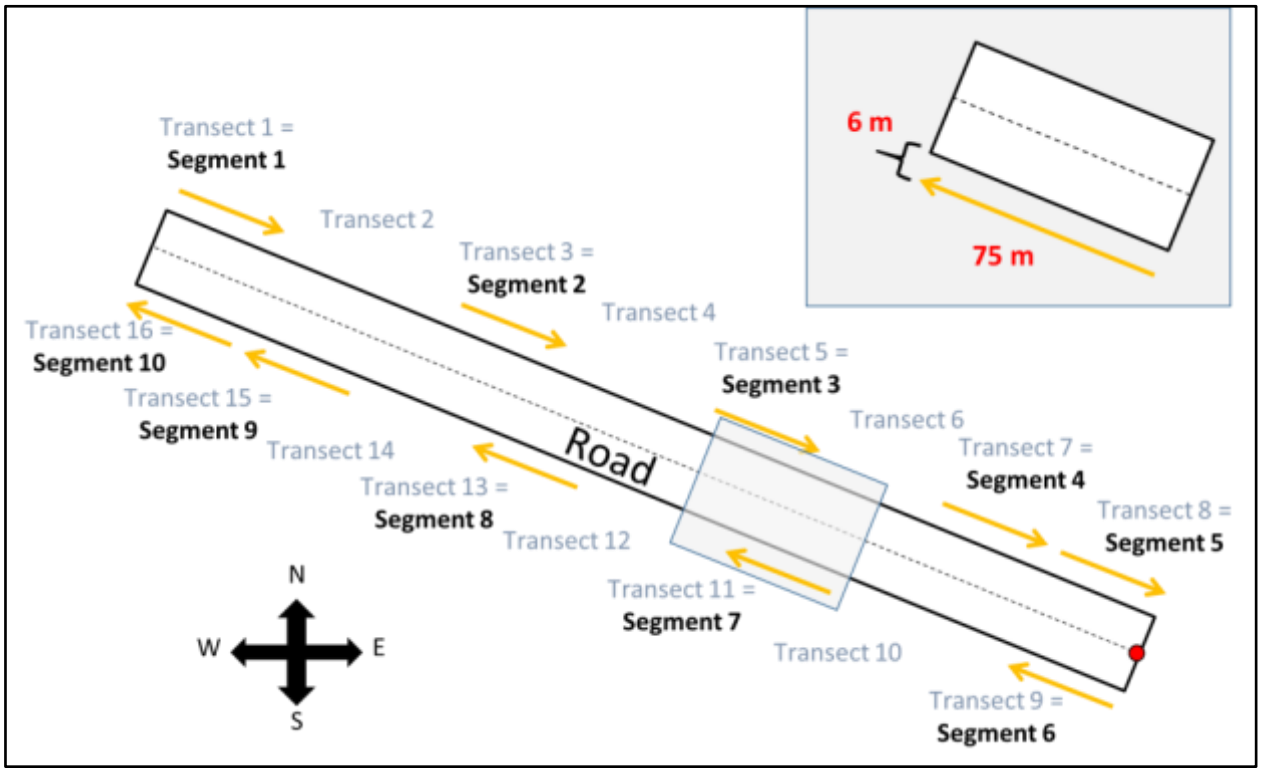

Figure SOP-2.2. Roadside plot with 10 segments for conducting the butterfly survey. Each segment is 75 m long. Bolded numbers (1, 3, 5, 7, 8, 9, 11, 13, 15, and 16) indicate the subset of 10 transects that are used as segments for recording butterfly counts, behavior and plant species used for nectaring.

c. Surveying in agricultural fields presents some challenges including access to the fields and the need to avoid trampling growing crops. The layout of the agricultural field segments will vary depending on conditions and not be fixed from site to site as it is for grasslands and roadside plots. Note, the orientation of the AGC plots will vary and not necessarily follow cardinal directions. Be sure to recognize the NW-most corner of the plot before starting the butterfly walk. The basic pattern of walking 750 m along ten, 75- m segments to survey monarch butterflies will be the same.

d. For agricultural fields where permission has been granted to walk in the field the survey will be conducted in the furrowed lanes between crop rows on the first 10 of 16 transects that will be used for sampling plants (SOP 3). Survey segments should be placed on the north side of a crop row, and the crop row for starting the survey is randomly selected (see Table SOP 1.3) and counted from the NW-most corner (SOP1).

e. When a field has furrows or crop rows that are 400 m or more long, then the preferred layout can be used for the survey. This entails placing 5 segments parallel to crop rows with 5 m between each segment, including between the edge of the crop row and the start of the first segment. The second set of 5 segments should be placed on the north side of the crop row that is 75 m distant from the first set of segments. Use a path that requires the least amount of crossing over planted crops

f. (e.g., walking in an adjacent furrow to get to the closest non-tilled edge to travel to the second set of 5 segments. Finish the butterfly walk (Figure SOP-2.3a).

g. If the field is too small to hold 5 transects in a single row, then you will need to enter more than two rows to walk along 10 segments to complete the butterfly survey (Figure SOP-2.3b). See SOP Table 1.3 for guidance for establishing survey routes when furrow and crop rows are less than 400 m in length.

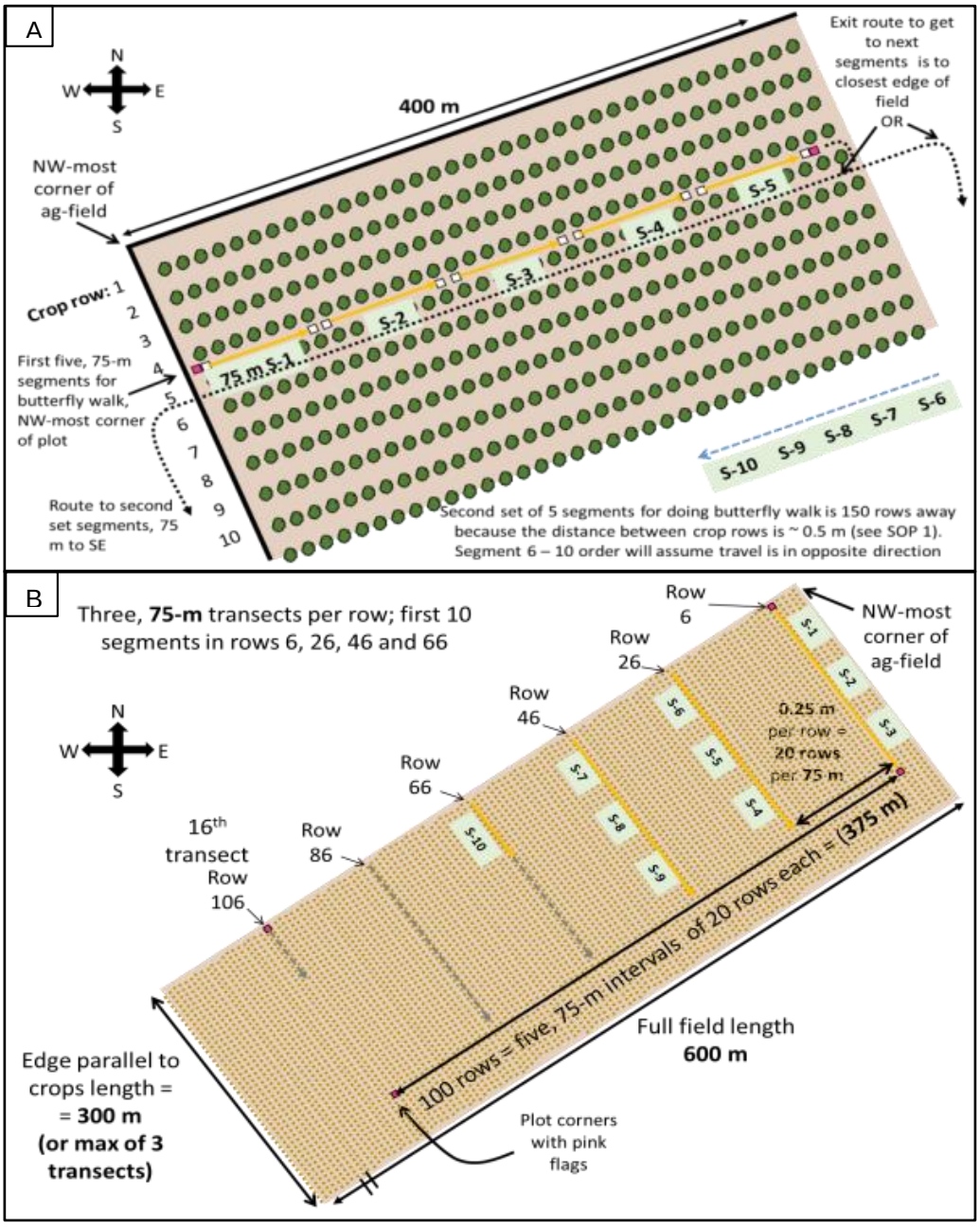

Figure SOP-2.3. Two examples of segment placement in agricultural fields (AGC plots) (A) the preferred arrangement with 5 segments in one row extending 400 m (5 m of space plus 75 m of segment x 5), and (B) a narrower field of grain crop that can only hold 5 sets of 3 transects plus 1 for conducting SOP3. Segment numbers per row and number of rows needed for the butterfly survey will vary by row length and crop type (Table SOP-1.3). Unlike in RDS plots, transect and segment numbering are the same in AGC plots.

Conducting the Survey—One person will conduct a slow walk to count adult monarchs at a site on a given day. Assistants can help with data recording. Monarch identification is found in Appendix B and must be distinguished from other butterflies and mimics (reference a butterfly field guide for your regions). Count and behavior surveys should be conducted between the hours of 1000–1600. Adult butterflies are most active on sunny, warm days between about 21–30 °C (70–87 °F), which represents a preferable temperature range for surveys. Cooler or warmer temperatures might cause the adults to stop flying. Do not survey if temperatures are below 16 °C (60 °F) or wind speeds above 40 km/hr (25 mph) or while raining. . Be sure not to disturb the plot before conducting counts. Conduct plant and monarch egg and larvae surveys (SOP 3) after conducting adult butterfly counts. Slowly walk the segment and count adult monarchs seen within 5 m of either side of the segment line.

1. What is a "slow walk"? Some people liken the pace to that of the "wedding walk" down the aisle. Expect to take 30-60 minutes to cover the total transect length of about 750 m.
2. Only count adults within the **monarch adult counting frame**, which is a 5-m window projected in front of, and to each side of you (SOP-2.4). Do not count butterflies behind you.
3. Although you will be counting all adults observed within 5 m on each side of the segment line, you will record the perpendicular (shortest) distance from the butterfly to the segment line using the following categories: (1) 0 -2.5 m and (2) 2.5-5 m. In other words, if a butterfly was first seen within 0 – 2.5 m of the transect line, you would record its perpendicular distance as "1" (first bin, 0-2.5 m) and if it was located between 2.5 – 5 m from the segment line when you first observed it its perpendicular distance would be "2" (second bin, 2.5 – 5m). The distance from the transect line to the monarch location is the perpendicular distance to the transect line, not the distance from you to the monarch (See Figure SOP-2.5). The distances recorded are based on the location at which you first encountered the butterfly within the observation window.
4. ***Do not count adults observed more than 5 m from the transect line***.
5. Avoid double-counting monarchs, especially as you turn corners in grassland plots.
6. You may have to pause to record data. Pause facing the direction you will continue walking towards, record your observations, and then continue the survey at a slow pace.
7. How can you estimate distances up to 5 m accurately so you can put the observations into their correct bin (0-2.5, 2.5-5 m)? First, we suggest a little bit of practice. Using a yard stick or tape measure, measure off 2.5 and 5 meters and see how many paces those distances correspond to. We suggest taking a piece of string 5-m long with you into the field. Mark its halfway point by doubling it over and tying a knot there. Before you start your survey, lay out the string to get a picture of 2.5 and 5 m in front and to the side of you. If you're having trouble during your survey, a quick refresher might help.
8. Additional marking can also be provided at the plot to indicate the bins.
9. The monarchs you observed might be flying or not. Count all monarchs you observe within the 5 m distance. The adults seen may or may not be moving. They may be **flying**, **resting**, **ovipositing**, **mating**, or nectaring (Figure SOP-2.6). Regardless of

their activity, if you see an adult in the 10-m wide (5 m on each side of the segment) by 5-m long area in front of you, count it, regardless of its height above the ground or its behavior.

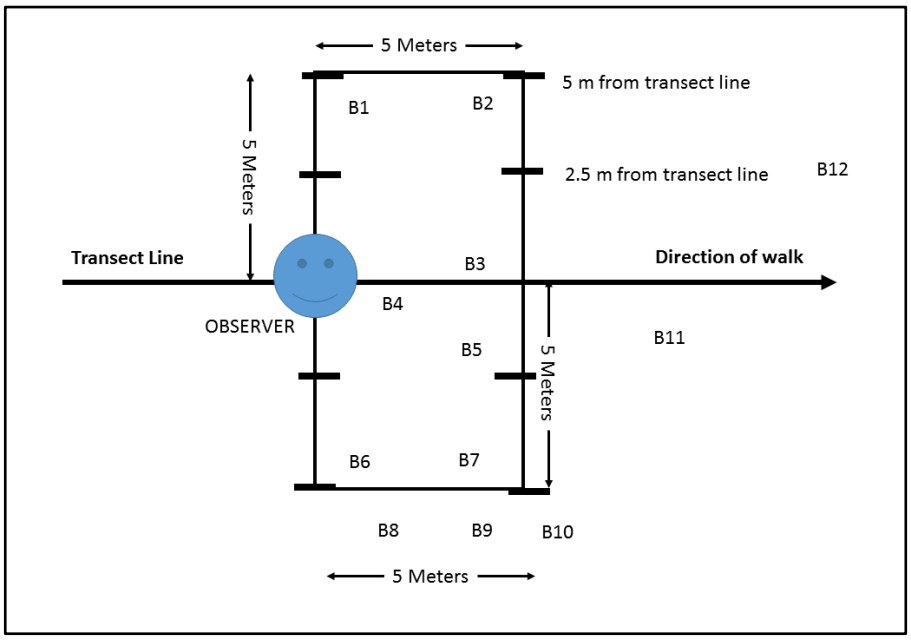

Figure SOP-2.4. The monarch adult counting frame. In this example, if B*x* is a monarch adult, there are 7 monarchs (B1-B7) counted within the 5-m counting frame, at this moment. B8-B12 are outside of the counting frame and are not counted. B3-B5 are seen within 2.5 m of the transect line. B1, B2, B6, and B7 are seen between 2.5-5 m from the segment line. The observer in this example is moving along the segment line from left to right. As the observer walks down the segment, the counting frame moves forwards and some of the butterflies, such as B11 and B12, may move into the frame and be counted.

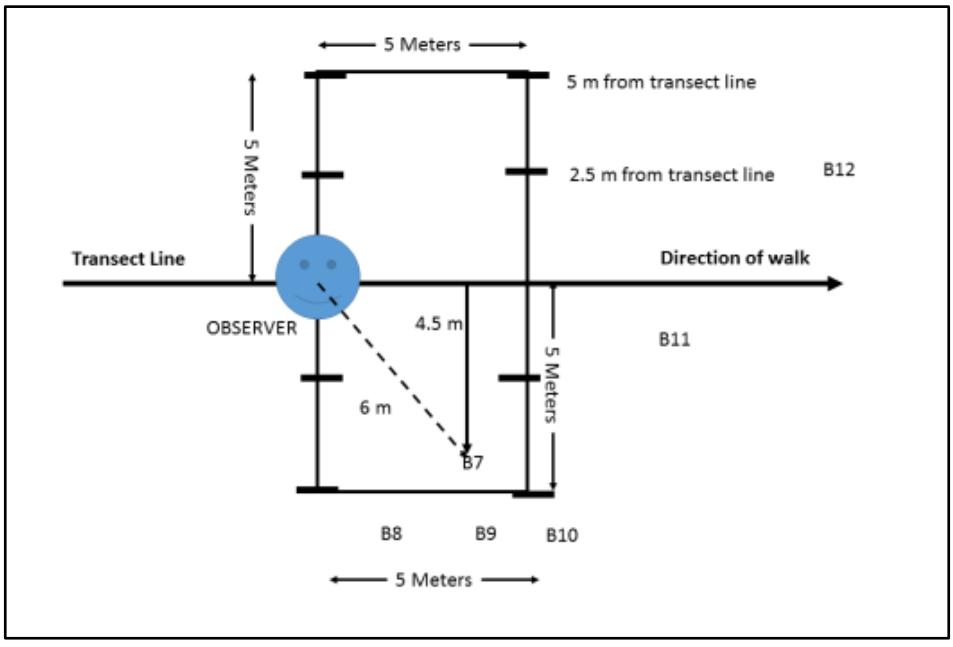

Figure SOP-2.5. Perpendicular distance from transect line to observed butterfly. Perpendicular distance: In this example, Butterfly B7 is 4.5 m from the transect line but 6 m from the observer. The distance from the segment line (4.5 m) is the shortest (perpendicular) distance to the segment line from the butterfly. It is the distance you need to estimate when recording numbers of adults by distance category and behavior (0-2.5 m, 2.5-5 m) on the data sheet.

When and How Often to Survey

In 2016, conduct adult monarch counts and record observations at least every three weeks from the time of first adult sighting through the end of the fall migration in your monitoring area. When time permits, conduct counts and record observations every two weeks at plots where monarchs have been more abundant. Counts and observations of monarchs conducted every three weeks should be done in conjunction with vegetation measurements (SOP 3), preferably on the same day.

A good way to figure out when to start doing adult counts is to consult the Journey North website and watch the maps of first sightings of monarchs in your area (https://www.learner.org/jnorth/maps/monarch.html). Also, watch for monarchs arriving to your sampling sites and local neighborhood.

In Texas (except Panhandle region), start counts and observations at the beginning of March and visit each plot through the end of April, and then every four weeks until about the beginning of October; when count frequencies should return to every two weeks. During 2016, counting will not start late, so we suggest an alternative schedule for Texas consisting of a count every three weeks from June through September, then every week during October (and into the first week of November in southern Texas). Further north, the schedule might start a week or two later and end a week or two earlier.

Northbound or southbound arrival dates can shift earlier or later depending on weather events. Watching for monarch arrivals, either live or online, is therefore important. Usually, the period from mid-May to mid-September should be adequate for latitudes north of Iowa. South of Iowa, arrivals in the spring will be earlier and migration south will be later so, outside of Texas, anticipate starting about two weeks earlier and ending about two weeks later.

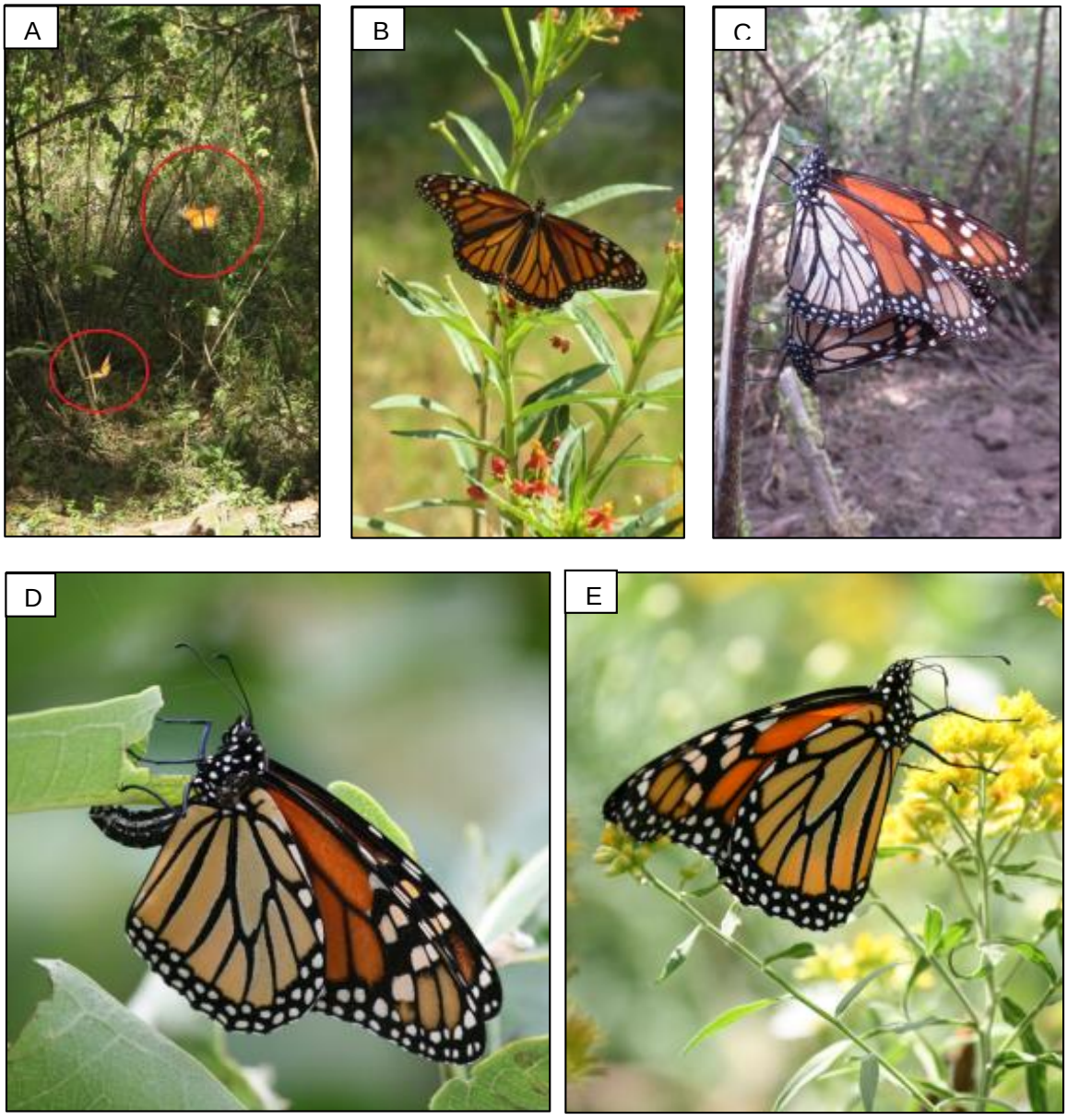

Figure SOP-2.6. Monarch behavior: (A) Two monarchs flying, (circled in red; photo courtesy of Holly Holt), (B) Resting (photo courtesy of Chuck Patterson), (C) Mating (photo courtesy of Holly Holt), (D) Ovipositing (photo courtesy of Candy Sarikonda), and (E) Nectaring (note that monarch's proboscis is extended into flower; photo courtesy of Candy Sarikonda).

References

Pollard E. 1977. A method for assessing changes in the abundance of butterflies. Biological Conservation 12: 115–134.